

chemical properties of the new gas. Prof. Ramsay explains clearly the splendid initiatory work of Lord Rayleigh on the density of the simple gases, and then records the successive steps by which the disturbing element was tracked and isolated. Though told in the plainest way, this story cannot fail to prove of dramatic interest even to the non-scientific reader. The account of the properties of argon, and of the difficulties which it raises in respect to the classification of the element, is in a more difficult strain than the rest of the book, and it is possible that a somewhat more extended treatment of the subjects of specific heat and the periodic law would have helped the general reader to a better understanding of the problems presented. At the same time it is right to say that, considering the bounds within which it is compressed and the difficulty of the subject, the account is very lucid, and it will be valuable to all readers who have some acquaintance with science.

In the last few pages of the book Prof. Ramsay gives some play to his scientific fancy, and attempts to offer an explanation of the anomaly presented by argon in respect to the periodic law. He concludes as follows:—

“It therefore appears to me not impossible that the mass of the atoms may be affected by the various and different properties which they possess, some to a greater, some to a lesser extent. It must be admitted that atoms differ from each other in the readiness with which they combine with those of the same kind to form molecules; and that molecules of different elements differ from each other in their capacity to form molecular aggregates. Take for example such cases as *cæsium* and fluorine, each intensely active, but towards different objects: *cæsium* the most electro-positive of the metals, and fluorine the most electro-negative of elements. Surely their activity must be due to some cause which cannot but exert influence on their other properties, such as their mass and their gravitational attraction, as it doubtless has influence on their specific heats and on many of their other physical properties. And contrast these instances with helium and with argon the most indifferent of substances, the atoms of which are unwilling to pair even with themselves; it is hardly conceivable that these peculiarities should leave their other, and, as we are in the habit of thinking, invariable, properties unaffected. I venture to suggest that these powers of combination, due to some configuration or to some attractive force, tend to lessen the gravitational attraction by which we measure their atomic weights; that helium and argon, which possess little, if any, of such power to combine, show what may be termed the normal atomic weights, inasmuch as their gravitational attraction is subject to no deduction attributable to their reacting powers.”

We cannot reproduce the considerations which lead up to the expression of this remarkable conjecture, and can therefore hardly do the author justice. Prof. Ramsay describes his suggestion as of a wholly speculative character. He expresses his “firm conviction that no true progress in knowledge has been made without such speculations.”

With this last statement in itself we are not inclined to disagree; the mind, baffled by difficulties in the paths of orthodoxy, may well be allowed to have its flights and seek more open ways, and there is a well-recognised scientific use of the imagination. But it is impossible to appraise any such speculation as the one before us, and we venture to think that it is rather presented as a *finale* to an interesting story—a sort of last chapter where all

ends happily—than intended for scientific criticism. Prof. Ramsay likens it to the doctrine of phlogiston; and certainly the assumption of “levity” is a point of resemblance. Otherwise we think the comparison unfair to the phlogistians. The idea of phlogiston was doubtless at its birth a speculation, but in science it ranks as a working hypothesis that guided several generations of investigators from point to point in their inquiries, that linked together a vast number of facts, and that even to the acute and sober mind of Cavendish appeared to throw as good a light on facts as the newer doctrine of Lavoisier. If Prof. Ramsay’s speculation proves fruitful, it may claim kinship with Becher’s; but hardly till then. The author recognises this, no doubt, as fully as any one. Meanwhile the situation between argon and the periodic law is not eased in any practical sense, and we are afraid that the book, which in many respects is an admirable exposition of the methods of scientific discovery, may prove somewhat misleading to the general reader in this one particular.

We cannot conclude this notice of a work dealing with the history of chemical discoveries relating to the atmosphere, without remarking upon the momentous part they have played in the development of chemical science. Viewing the discovery of argon in the light of earlier discoveries respecting the air, we feel that it is worthy to rank with the best of them, both in the manner of its inception and of its experimental realisation. The discovery has already raised questions of fundamental interest in physics and chemistry, and there seems no reason to believe that it will not prove as fruitful in important consequences as any of the earlier masterpieces of experimental work relating to the gases of the atmosphere.

A. S.

THE FENS OF SOUTH LINCOLNSHIRE.

A History of the Fens of South Lincolnshire. By W. H. Wheeler. Second edition. Pp. 489, and appendices. (Boston: J. M. Newcomb. London: Simpkin, Marshall, and Co.)

THIS book, which is nominally a second edition of a book published in 1868, but has in reality been entirely re-written and enlarged, relates merely to the fens of Lincolnshire, situated between the Steeping River and the Nene, comprising an area of 363,000 acres, and does not refer to the fens of Norfolk, Cambridgeshire, and the adjacent counties, or to the rivers Ouse and Nene, which, with the rivers Witham and Welland, are known as the fen rivers. In fact, the author naturally deals with the fen districts in his near neighbourhood, having resided for many years past at Boston, on the Witham. The history of these fens is traced back to the time of the Britons, and more particularly to the Roman settlement which was made very early in the Christian era; and to the Romans in the time of Severus, are attributed the construction of the first banks protecting the district from the sea, the land being from 1½ to 12½ feet below the level of high-water of spring tides, to which probably the appellations North and South Holland, denoting certain portions of the fens, are due. Lands outside the Roman banks have been gradually raised by the process of warping, or accretion,

from the deposit of materials brought down the fen rivers in flood-time, and have then been enclosed and drained. The area of land thus reclaimed from the sea, since the formation of the first sea banks about 1700 years ago, amounts to 63,300 acres, or an average yearly addition of $37\frac{1}{4}$ acres. Mr. Wheeler points out that the reclamations must be gradual, owing to the limited quantity of fertilising alluvium brought down by the rivers, and that the schemes which have occasionally been brought forward for enclosing large areas of the sandy foreshores of the Wash, adjoining the fens, would be financial failures on account of the barren nature of the sands before they are covered over with warp.

The subject is dealt with in seventeen chapters, followed by eight appendices; and it is illustrated by fourteen maps of the various districts, and two diagrams exhibiting the strata, levels, and rainfall of the fens. Unfortunately, no pages are given in the table of contents, which renders reference to the different chapters and illustrations a tedious search; and marginal headings in small print only partially compensate for the absence of top headings to the pages, and the entire omission of notes. A general early history of the fens is given in the first chapter, and the several drainage districts are described in turn; and special chapters are devoted to the river Witham, the river Welland, the estuary and its reclamation, Boston Harbour, and the Witham Outfall, with which the author has long been professionally connected, the geology and water-supply of the fens, and a concluding chapter on the natural history, products, climatology, and health of the district. The inhabitants of the fens have had to maintain a constant struggle with nature, first in rescuing and preserving these fertile lands from the sea, and by degrees increasing their extent by fresh enclosures; and secondly, in improving the drainage of these flat low-lying districts by straightening, enlarging, and embanking the channels of their rivers, and supplementing them by numerous straight drains, so as to prevent the inundation of the lands in times of heavy rainfall. Pumps also have been extensively introduced to remove the water from the lands, and to assist in the drainage of the district, which, owing to the small fall, cannot be wholly effected by gravitation. Sluices placed across the rivers in the neighbourhood of their outfalls, with gates to arrest the tidal flow, and thus secure the land above from any chance of an inroad of the sea, through breaches in the embankments along the river banks, have naturally, in conjunction with silting in the Wash, produced a deterioration in the depth of the outfalls, which has been detrimental to drainage as well as navigation. The straightening, however, of the outfall channels has effected some improvement; and the formation of a more direct outlet for the Witham, by cutting a new channel for the river, in 1880-84, two and a quarter miles long, through a projecting clay bank below Boston to deep water in the Wash, has effected a great amelioration in the navigable channel between Boston and the sea, and in the outflow of the drainage waters, which latter was at the same time further facilitated by an enlargement of the Grand Sluice above Boston.

The author being an engineer, has perhaps given more prominence to the engineering features of the

history of the fens than another writer might have done; but unquestionably the prosperity, and even the existence of the fens are almost wholly dependent on engineering works. The book, however, does not pretend to give detailed descriptions of the works carried out, which have been recorded by Mr. Wheeler and others in engineering publications; and the book will chiefly interest archæologists and topographers, and especially those who live in the neighbourhood of the districts described. Though Mr. Wheeler, as an old inhabitant, has given somewhat too rosy a description of the attractions of the fens on pages 2 and 486-487, where the features of the landscape are banks, drains, windmills, and occasional church towers, and keen north-east winds often prevail through the spring up to June, he shows great interest in the country he resides in, extending to minute details on a variety of topics, and has produced a volume exhibiting considerable labour and research.

OUR BOOK SHELF.

Bacteria of the Sputa and Cryptogamic Flora of the Mouth. By Filandro Vincentini, M.D. Translated by Rev. E. J. Stutter and Prof. E. Saieghi. Pp. x + 239. (London: Ballière, Tindall, and Cox, 1897.)

THIS volume is a collection of three monographs and an appendix, viz. First memoir: On the Sputa of Whooping Cough. Second memoir: Recent Bacteriological Researches on the Sputa. Third memoir: On *Leptothrix racemosa*.

Without in the least wishing to detract from the earnestness, enthusiasm and laudable industry of Dr. Vincentini, we are sorry to have to confess that this book is what, in Germany, would be called an overcome standpoint—*ein überwundener Standpunkt*. Fifteen years ago, prior to the introduction, by Koch, of exact methods of bacteriological study, this book, dealing with the purely microscopic examination as to size and shape of micro-organisms in the sputa and of the mouth, would have had some *raison d'être*; not so at the present time. Everybody knows that if you talk of a bacterial species, of pathogenic and non-pathogenic organisms, you mean not merely the size and shape of a microbe, but that you have studied its biological, chemical and cultural characters, and that you have ascertained whether or not, and under what conditions, it possesses, or is devoid of, pathogenic properties when introduced in one way or another, experimentally or otherwise, into the animal system. Of all this, Dr. Vincentini is quite innocent. To assert, as he does from purely microscopic examination, that a host of microbes—bacilli, cocci, vibrios, and spirilla, occurring in the sputa and in the fluid of the mouth—are all derived from, or are parts of, a single species "*leptothrix*," requires either tremendous courage, or is due to a want of appreciation of the enormous amount of exact work hitherto accomplished. The discussion in the appendix, by Dr. Vincentini, of the views of antiquated authors on spontaneity of origin of infectious diseases, and, further, his extraordinary derivation of the tubercle bacillus, spirillum of relapsing fever, gonococcus and pneumococcus from the indifferent *leptothrix*, is an anachronism of a curious and, we had hoped, extinct type.

E. KLEIN.

Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus. Nos. 7-9. Edited by Prof. Dr. G. Hellmann. (Berlin: A. Asher and Co., 1897.)

THESE reproductions in facsimile of classic papers in meteorology and terrestrial magnetism are attractive in appearance, and Prof. Hellmann's introductions and